SWIFT FOX DENSITY ESTIMATION AND SURVEY TECHNIQUE EVALUATION IN SOUTHEASTERN WYOMING, 1996.

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ABSTRACT

We report on our efforts to evaluate and compare several survey techniques for the purpose of monitoring swift fox populations in Wyoming. During March-April 1996, sixteen swift fox were live-trapped, radio-collared and released in a 220 km^2 study area located in sagebrush-grassland habitat northeast of Medicine Bow, Wyoming. Using mark-resighting procedures, we estimated spring abundance at 28 swift fox (1.6/10 km^2). We evaluated and compared three survey techniques during the spring and fall 1996, and winter 1997. Scat surveys provided the greatest swift fox detection rate in the spring, followed by tracking plate and spotlighting surveys, respectively. Tracking plate surveys had the greatest swift fox detection rate during the fall, followed by scat counts and spotlighting surveys. During the winter, tracking plate surveys provided the highest swift fox detection rate, followed by spotlighting. Scat surveys were not conducted during this period due to snow-covered roads. Swift fox were detected more often in fall than either spring or winter using both tracking plate and scat count surveys, while spotlighting detection rates decreased from spring to winter. Advantages and problems associated with each survey technique are discussed.

INTRODUCTION

The swift fox (*Vulpes velox*) was proposed for listing as endangered under the Endangered Species Act in 1992. Subsequent review of this request by the U.S. Fish and Wildlife Service (FWS) resulted in a warranted but precluded finding in 1995. This finding provided an opportunity for affected states to gather and provide additional information to the FWS to be

considered when they revisited their initial finding. Wyoming has since initiated research to address the data needs identified by the FWS in the review that led their finding. Progress toward the goals identified in the Swift Fox Conservation Strategy (Kahn et al. 1996) should further reduce the likelihood of the swift fox being listed.

We report on our efforts to develop and test survey techniques for the purpose of monitoring swift fox populations, one of the goals identified in the Swift Fox Conservation Strategy. We had two principle objectives in this study. Our first objective was to provide a swift fox density estimate within a 220 km^2 (84 mi^2) area of suitable habitat. Our second objective was to compare the relative effectiveness of three survey techniques (road spotlighting, scat surveys, and tracking plate surveys) for detecting swift fox presence and monitoring trends in population size. The ability to properly evaluate the latter requires evidence that, in fact, a strong relationship exists between the chosen monitoring index and changes in population size. To determine this requires true replication, preferably across a broad range of natural fox densities, and therefore is beyond the scope of this study alone. However, if we assume that a moderate to strong relationship exists, we can evaluate each technique on the basis of detection rate, *i.e.*, greater detection rates or frequencies likely confer greater sensitivity in detecting population size trends, assuming all swift fox detections are reliable and independent.

STUDY AREA

We selected two sites for study within the range of the swift fox in eastern Wyoming (Fig. 1). The principle study area was located in western Albany County, Wyoming, approximately 15 km northeast of the town of Medicine Bow, east of the Medicine Bow River. This site is approximately 220 km^2 in size, and supports primarily a sagebrush-grassland plant community at an elevation near 2075 m (6,800 ft). The topography is flat to mildly undulating, with numerous dry lakebeds and several saline lakes. The habitat is principally grass dominated, interspersed with individual and small patches of low-growing (<1 m) sagebrush (*Artemisia tridentata*), and greasewood (*Sarcobatus vermiculatus*).

A secondary study area was located northeast of Cheyenne, in Laramie County, Wyoming at an average elevation of 1800 m (5900 ft; Fig. 1). The southern third of this area is characterized by rolling hills consisting of more typical short and mixed-grass prairie. The northern section is a more broken landscape composed of grassland interspersed with shrublands associated with low-crested buttes and hills.

There is very little human development in either area with the exception of windmills, stock ponds, fenceline, and numerous secondary dirt roads. Landownership was principally private; cattle grazing was the dominant land use.

METHODS

Sixteen swift fox were captured over 1166 trap-nights in Medicine Bow during March and April 1996 (1.4 fox/100 trap-nights). Six swift fox were captured over 624 trap-nights in Cheyenne

during June 1996 (1.0 fox/100 trap-nights). Swift fox were captured with Tru-catch live traps using butcher scraps as bait. Traps were set every 0.8 km (0.5 mi) along roads and run for 3-5 successive nights. Each captured fox was ear-tagged, weighed, radio-collared, and subsequently released. Sighting frequencies of marked and unmarked animals were later obtained during spotlighting surveys (described later) conducted in the May 1996.

Density of swift fox was estimated using mark-resight procedures, calculated with the program NOREMARK (White 1996). We selected the (immigration-emigration) joint hypergeometric maximum likelihood estimator to estimate population abundance. This estimator assumes that the population is geographically open (allowing for immigration and emigration across study area boundaries), but demography closed, and that each individual fox has an equal probability of being resighted.

We evaluated and compared survey techniques within the Medicine Bow site over three time periods: spring, fall and winter. Spring surveys were conducted between 23 April and 15 May 1996, corresponding to the time period we felt that adult fox populations would be at their lowest level. Fall surveys were conducted between 26 August and 12 October 1996, when we expected young of the year foxes to be independent. Winter surveys were conducted between 7 January and 27 February 1997, corresponding with pair formation and breeding.

Spotlighting was conducted during each sampling period in the Medicine Bow Study Area (Medicine Bow), with two replicates in the fall; and once during mid-August in the Cheyenne Study Area (Cheyenne). In Medicine Bow, 155 km of secondary roads were spotlighted over three nights between two routes, while 90 km were spotlighted in Cheyenne over three nights (one route). Each route was surveyed using a roof-mounted, 50-watt spotlight while driving at speeds from 16 to 32 kmph. Each survey began shortly after sundown and usually took between five and six hours to complete. All visual observations of swift fox were recorded by time, whether marked or unmarked, and by location. Most observations were in the form of animal eyeshine where swift fox were confirmed using 10 x 28 or 10 x 40 binoculars. Surveys were not conducted during periods of rainy or snowy weather.

Twenty 1.6 km (1.0 mi) road transects were randomly selected in Medicine Bow with the provision that transects were not located within 1.6 km (1.0 mi) of each other. Scat surveys were conducted along each road transect (secondary and two-track dirt roads) each season by walking the road twice while searching for scat resembling known swift fox scat previously collected at den sites. Each scat was collected and labeled in paper bags. Search efforts were restricted to the road track or road side vegetation. Only relatively fresh swift fox scat were counted and collected during spring surveys to minimize the bias of pre-survey scat accumulation. Scat surveys were not conducted during the winter sampling period due to persistent snow cover.

Following scat surveys, we placed ten 61 x 61 cm metal plates (16 gauge sheet steel) spaced at 0.1 mile intervals along each transect in the roadside vegetation. Plate surfaces were sprayed with an ethanol/talcum mixture, leaving a thin talc film. A scent tab, soaked in a trailing scent preparation (cod-liver oil/mackerel mix), was placed in the center of each plate as an attractant.

Tracking plates were left in place for three successive nights and checked for tracks each following morning. If the tracking surface was obscured by rain, tracking plates were left out for an additional night. Tracks that were clearly identifiable as swift fox tracks were recorded and measured. Tracks that were not clearly identifiable as belonging to swift fox were photographed for further examination.

The transect was designated as the sample unit for statistical comparisons among survey techniques. We examined the responses of two variables: survey technique (scat and tracking plate surveys) and season (three levels). The response variable was categorical (two levels), depending on whether swift fox were clearly detected or not detected on each transect. We conducted pairwise comparisons between techniques and between seasons using McNemar's test, a small, related sample binomial test for differences in proportions (p; Agresti and Finlay 1986). Tests were deemed significant at a P-Value of 0.05. Experiment-wide error rate was controlled using the Bonferonni approach ($P = 0.05/7$ tests; Byers et al. 1984). Spotlighting results were compared descriptively since the survey route was the sample unit (n=1 per site).

Computer simulations were conducted in an effort to determine the effective number of plates required per transect to detect swift fox presence in the fall. Two simulations were conducted, each with 200 replicates: (1) swift fox detection frequencies were determined while randomly removing n plates from each transect, (2) detection frequencies were determined by randomly removing n plates from each transect, while simultaneously truncating transect length accordingly. Simulations were not conducted for tracking data collected in the spring or winter periods because so few plates were visited by swift fox.

All statistical analyses and simulations were conducted using Minitab (release 9.1).

RESULTS

Density Estimation

Spring swift fox abundance was estimated at 28 individuals (17-65, 95% CI) in Medicine Bow. We trapped and spotlighted within an area of 168 km^2 (65 mi^2), giving a point density estimate of 1.6 fox/10 km^2 (4.1/10 mi^2).

Technique Evaluation

Overall, we detected more swift fox spotlighting in Medicine Bow during the spring (2.4/day/100 km), than either late summer (1.5/day/100 km), fall (0.9/day/100 km), or winter (0.5/day/100 km; Table 1). Survey precision was greatest during spring (coefficient of variation [cv]=16%, n=3), while lowest during the winter (cv=140%, n=2). We detected five swift fox during mid-August surveys in Cheyenne (1.9/day/100 km, cv=70%, n=3). Combining all detections across sites and seasons (excluding spring), 56% of all swift fox sightings were on the road track (n=18). However, we had many unconfirmed sightings located well off the roads. We counted only sightings in which swift fox were positively identified.

Swift fox were detected significantly more often in the spring using scat surveys (p=0.5, n=20) than tracking plates (p=0.2, n=20, P=0.000; Table 2). Swift fox were detected more often in the fall using tracking plates (p=0.9, n=20) than scat surveys (p=0.85, n=20; P=0.313), but the difference was not significant.

During scat surveys, swift fox were detected more often during the fall (p=0.85) than spring (p=0.5), but the difference was not significant (P=0.018, n=20). Most of the scats (95%) were observed directly on the road track during the fall surveys, suggesting that swift fox use secondary roads as travel routes. Tracking plate surveys detected more swift fox in the fall (p=0.9), than either spring (p=0.1, P=0.000, n=20) or winter (p=0.33, P=0.001, n=18). Combining results for both techniques, we detected more swift fox in the fall (p=1.00, n=20) than either spring (p=0.5, P=0.000, n=20) or winter (p=0.33, P=0.000, n=18).

Tracking plates were run for three successive nights during the spring and fall periods. Swift fox were detected in the spring only on the first night (/=2, n=20). During the fall, however, swift fox were detected on 14 transects the first night, and two additional transects each night thereafter, for a total of 18 transects (n=20).

Swift fox tracks were measured for those recorded on tracking plates in the fall. Swift fox tracks averaged 24x33 mm in dimension (sd=2x4 mm; range = 20-33 mm width, 23-41 mm length; n=18 transects).

Computer simulations were conducted to determine the number of plates required per transect to simply detect swift fox presence (Fig. 2). When plates were removed at random from the data set, swift fox were detected with an average frequency of 6 per 20 transects using a single track plate, suggesting that 10 plates per transect were unnecessary to detect presence within this swift fox population. When transect length was simultaneously reduced, detection frequency curves mirrored that of the random plate removal simulation, but at a decreased level, suggesting that transect length is somewhat correlated with detection frequency. The validity of this simulation is dependent upon the assumption that the collection of ten plates does not influence the likelihood of a swift fox visiting a single plate.

DISCUSSION

Density Estimate

Because we found no density estimates for swift fox in the literature, we were unable to directly compare our density estimate for the Medicine Bow study site to other areas. Fitzgerald et al. (1983) live-trapped 36 adult swift fox in a 212 km^2 area (1.6/10 km^2) over a three year period in northeastern Colorado. By comparison we captured 1.0 fox/10 km^2 in Medicine Bow and 0.3 fox/10 km^2 in Cheyenne over a much shorter time period. Hillman and Sharps (1978) located six independent den sites within 77 km^2 in southwestern South Dakota. Assuming one adult pair per

den site, these data suggest a minimum density estimate of 1.6/10 km^2, comparable to our density estimate in Medicine Bow (1.6/10 km^2).

Technique Evaluation

All three techniques were effective in detecting the presence of swift fox, regardless of time of year. Although scat surveys were not conducted during the winter, scats were frequently observed along fencelines and roads during this time period. However, we recorded greater detection frequencies for both scat surveys and tracking plates during the fall sampling period. This time of year likely corresponds to a period when a swift fox populations are at their greatest size. Unfortunately, fall may be the least desirable time of year if the goal is to monitor the resident population, since yearly variations detected in population size could reflect differences in productivity of local populations. Spring, early summer and perhaps winter may therefore be preferable to monitor resident populations.

The validity of any design utilizing indices to monitor changes in abundance is predicated upon strict standardization of data collection protocols. Standardization for the purpose of monitoring may not be achievable during winter, regardless of technique, due to yearly variations in weather severity. For example, because of weather conditions, we were unable to run tracking plates for three consecutive days, as was done during the other two seasons. Tracking plate results were also very sensitive to weather. Snow fall and blowing snow frequently obscured tracks. We also found that ice tended to form on metal plates shortly after dusk during most nights. In addition, we were unable to access two transects sampled in previous seasons due to drifting snow. Persistent ice and snow covered the roads, preventing us from conducting scat surveys during the winter. Yearly variations in snow depths may also influence swift fox movements on roads further increasing yearly variation in detection rates, thus requiring greater sample sizes to detect true yearly changes.

Early summer (late June through July) may be the best time of year to conduct surveys for the purpose of monitoring changes in population size. Precipitation is generally low, providing more stable field conditions. We found that spotlighting was only moderately effective during this time of year (conducted in early May), and our results suggested that spotlighting may not be sensitive to increases in population size. We did not observe an increase in observations expected in the late summer and fall sampling periods associated with juvenile independence and dispersal. Conversely, tracking plate and scat survey results showed significant increases in detection frequencies from spring to fall. Unfortunately, our results indicated tracking plates were the least effective technique of the three for detecting swift fox during the spring. This may be partially a function of prey availability during this time of year, or perhaps, merely sampling error. Scat surveys were moderately effective in the spring, but this technique should not be used alone until it can be proven that swift fox scat can be reliably identified.

We identified several practical problems associated with each survey technique. As discussed earlier, tracking plate results are easily obscured by precipitation, and metal plates tend to form ice in subfreezing weather. Setting and checking tracking plate transects is also time intensive,

and requires and an investment in treatment materials (ethanol, talc, applicator, lure). If yearly monitoring were to be implemented, there is also a potential for behavioral modifications in individual foxes following initial exposure to plates. Conversely, an advantage with tracking plates is that observer bias is low, and swift fox tracks are not likely to be confused with those of other species. Tracks can be photographed or the plate removed for further examination if track identification were initially in doubt.

Problems associated with spotlighting include observer bias, sightability biases associated with different habitats, and perhaps alterations in swift fox behavior after being initially exposed to spotlights. Spotlighting is also time intensive, but offers the advantage that swift fox presence is confirmed visually, and other nocturnal wildlife populations can be surveyed simultaneously.

Of the three techniques examined, scat surveys would be the most appealing since there is no need to interact with individual animals, and surveys can be conducted with minimal costs. We found that most scats were observed directly on the road tracks. Restriction of survey efforts to the road track would help minimize observer bias, and simplify search efforts. However, until a reliable method is developed to positively identify swift fox scat, and thus separate swift fox scat from other small carnivores, we feel that this technique cannot be reliably used alone to monitor changes in population size.

In conclusion, we found no completely effective monitoring technique. Our results indicated that of the techniques examined, tracking plates in the fall provided the greatest detection frequency. However, this is the least desirable time of year to monitor populations because yearly variations in population size may partially reflect productivity. In addition, due to yearly variations in weather, it may be difficult to standardize tracking plate effort. However, tracking plate surveys run in the fall appear to be the most viable approach to detecting the presence of swift fox.

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Table 1. Results of spotlighting surveys for swift fox in the Medicine Bow, WY study area (1996-1997).

Season	Total seen	Total /day /100 km	Average /day (sd)	CV[1] %
Spring	11	2.4	3.7 (0.6)	16
Late summer	7	1.5	2.0 (1.0)	50
Early fall	4	0.9	1.3 (0.6)	46
Winter	2	0.5	0.5 (0.7)[2]	140

[1]coefficient of variation.
[2]estimated from only two complete surveys.

Table 2. Proportion of transects detecting swift fox using scat surveys, tracking plate surveys, and the two techniques combined.

Survey technique	Season		
	Spring	Fall	Winter
	n=20	n=20	n=18
Scat counts	0.50	0.85	n.s.[1]
Track plates	0.10	0.90	0.33
Combined	0.50	1.00	0.33

[1]Scat surveys not were conducted due to snow-covered roads.

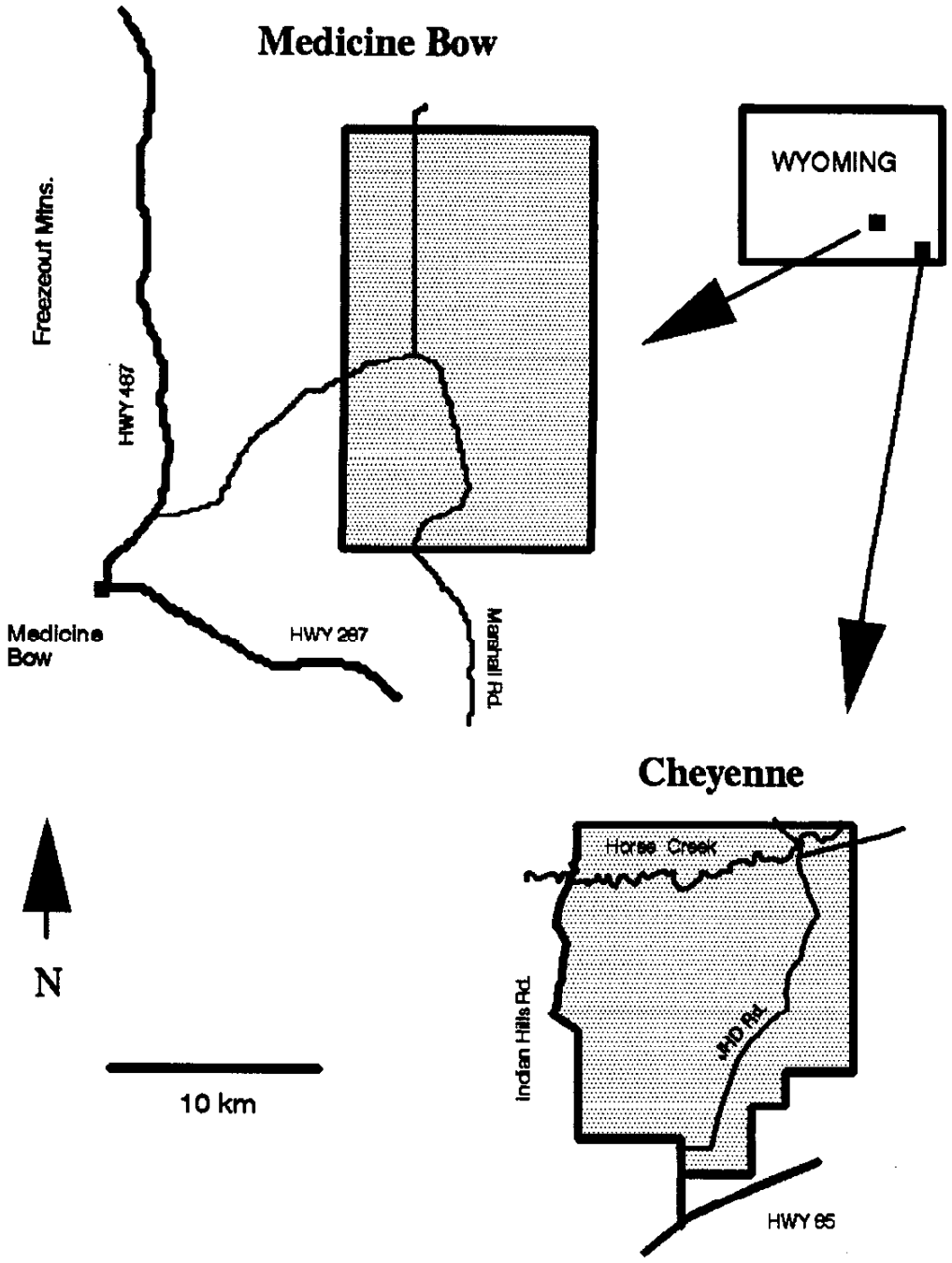

Figure 1. Swift fox study areas in southeastern Wyoming.

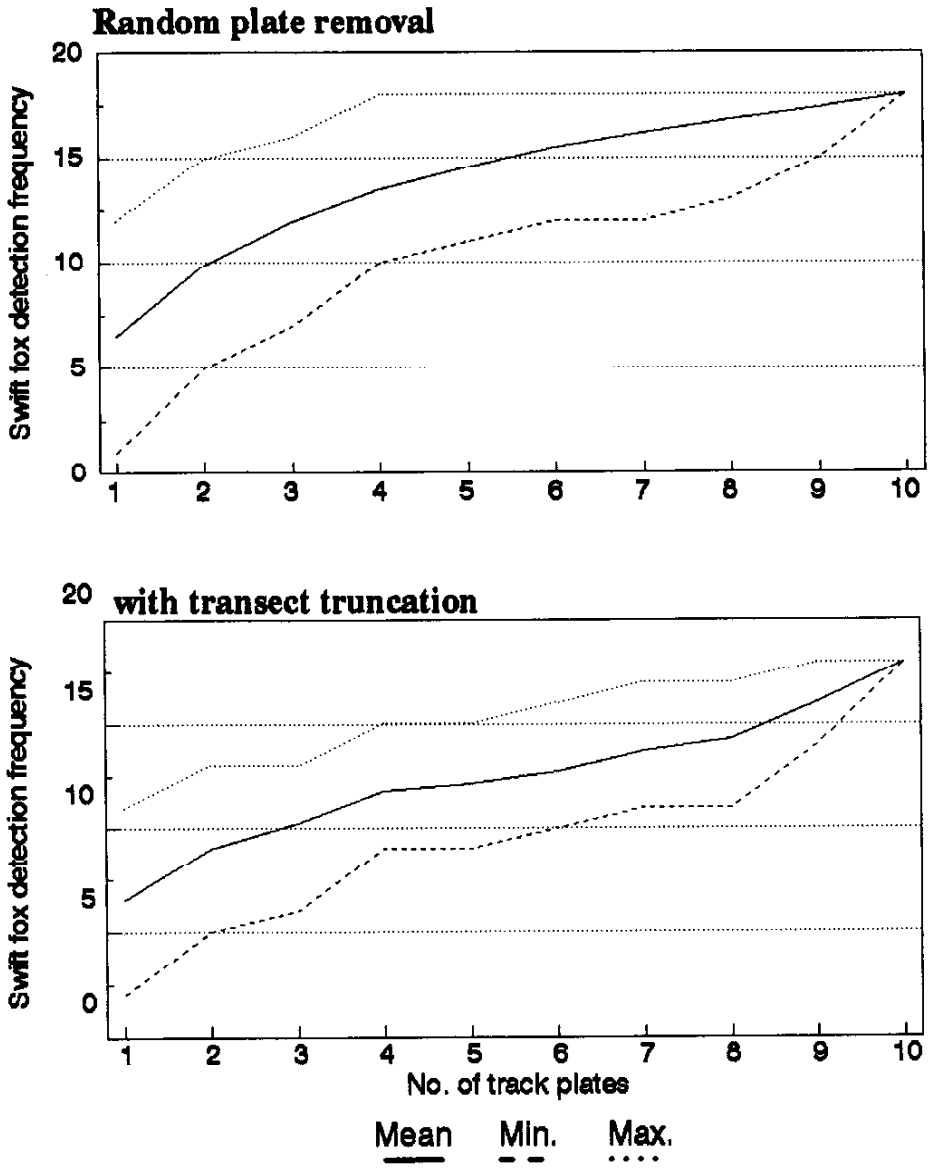

Figure 2. Random plate removal simulation to determine the number of tracking plates required per transect to detect the presence of swift fox. See methods for simulation description.

SUMMARY OF SWIFT FOX RESEARCH ACTIVITIES CONDUCTED IN WESTERN KANSAS - ANNUAL REPORT

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INTRODUCTION

Meaningful survey methods to estimate relative density of swift fox populations are unavailable. Although an estimate of population size may be a desired goal and preferred to estimates of relative density, it is not necessarily more useful nor a realistic goal. A density index can provide information about swift fox populations through observing long term trends in single populations, and comparing one population with another. Currently, the most common survey methods used by state agencies include spotlight indices, scent-station surveys, catch per unit effort, and track surveys. However, estimates from these sampling methods have not been compared to known population levels and thus, results are difficult to interpret.

In 1996, we began a study to evaluate the usefulness and precision of survey methods for estimating distribution and abundance of swift foxes. Surveys evaluated were: 1) scent-post survey, 2) spot-light survey, 3) line-transect track survey, 4) quarter-section surveys for tracks, and 5) scat-deposition rate survey. In addition to evaluating monitoring methods, information was gathered about the biology and population parameters of swift foxes which will contribute to population modeling and viability analyses.

STUDY AREAS

This evaluation was conducted in two 4754 km^2 (100 mi^2) study areas in western Kansas. The areas represented different land uses and predominant habitat types. One area was dominated by small grain agriculture (hereafter called cropland area), the other was dominated by large continuous grassland, primarily pastures (hereafter called range area). The cropland area was relatively flat and was dominated by cropland, primarily under a winter wheat--fallow crop rotation. Other major crops included corn and sunflowers. Several fields were enrolled in the Conservation Reserve Program (CRP). The range area had gently rolling hills and was dominated by moderately to heavily grazed native grassland with few cultivated (corn, wheat, sunflowers, alfalfa) and CRP fields interspersed .

METHODS AND PRELIMINARY SUMMARY

Swift foxes were captured using fox-sized boxtraps, beginning in March 1996. Intensive trapping occurred on three randomly selected 10-km^2 blocks located within each study area boundary. Each captured fox was fitted with a radio transmitter (collar) equipped with a mortality sensor. Our goal was to radio-collar at least one, but preferably all, adult swift fox from each family unit

residing in the 10-km^2 blocks. When dens of unmarked foxes were located within the 10-km^2 blocks, we selectively set traps in the area to capture them. If trapping failed, we used a den-site trapping method described by Covell (1992) to capture adult foxes residing at the den. In some areas, swift fox adults outside the focal region, but within the study area, were also captured and radio-collared. Captured foxes were sexed, weighed, and measured. Incisor wear was recorded to categorize age groups (Rongstad et al. 1989). Females were checked for pregnancy by abdominal palpation and noting lactation.

Radio-collared foxes were systematically monitored beginning in March 1996 and continuing through September, and periodically monitored through January 1997. Monitoring was conducted using vehicle-mounted tracking equipment. Sampling occurred eight nights every two weeks (including tracking during tests of survey techniques).

We estimated home ranges of adult foxes using minimum convex polygon method (Mohr 1947) for animals with a minimum of 30 locations. We determined composition of fox families in our study areas. Using this information, we estimated how many family home ranges were located on the entire study area and how many foxes were exposed to the survey methods being evaluated (see below). We estimated survival rates with Kaplan-Meier estimation techniques in a staggered entry design (Pollock et al. 1980).

We captured 19 adult swift fox on the cropland area and 19 on the range area. Average home range using only foxes with a minimum of 30 locations was 1882 ha for eight females and 3410 ha for nine males in the cropland area, and 1784 ha for seven females and 2286 for seven males in the range area. We did not detect differences in home range size between sexes ($P = 0.18$) or study areas ($P = 0.76$). The preliminary survival rate estimates were 42% for all adults, 46% for adult females, and 39% for adult males.

Survey Methods: Tests of survey techniques were conducted from March through September (described below). Swift foxes care for young during most of this portion of the year, therefore populations were relatively stable (little emigration and immigration) and probably comprised relatively evenly spaced social groups. Surveys were conducted using standard techniques, unless stated otherwise. We established five survey routes within each of the two study areas. Each route consisted of 8-km sections of roads or two-track trails, spaced throughout the study areas. The same routes were used for each survey method with exception of modifications to three routes because of landowner concerns or change in accessability.

Data analyses of survey methods are currently being conducted; final results are not available. Results of surveys and the density of swift foxes will be compared to determine if surveys were reliable indicators of abundance. The different survey methods will be evaluated for relative utility, efficiency, and cost for monitoring distribution of swift foxes and for monitoring relative abundance and population trends.

Models will assist in the design of surveys to best detect change in population density and will provide insight to what magnitude of change must occur for surveys to detect a change. We will

look at variables that may affect surveys such as location of survey lines relative to habitat and spacing of sampling points.

The following describes survey methodology and includes a brief summary of data collected:

Spot-light surveys -- Spotlight surveys were conducted five times on each study area between March and August at approximately five week intervals. Surveys were conducted between 2300 and 0300 hrs. Observers used a 200,000-400,000 candlelight spotlight from vehicles driving at speeds between 10 km/hr and 25 km/hr. When eyeshine was observed, the vehicle was stopped and binoculars were used to aid in identification of the animal. Radio-receivers were used to identify marked foxes. While the surveys were being conducted, radio frequencies were scanned to determine if radio-collared foxes were active near survey routes.

On the 10 survey routes, we detected at least one swift fox on two routes in March, three routes in April, one route in May, three routes in July, and three routes in August. Overall, nine of ten adult swift foxes seen during spotlighting were radio-collared; we also observed three pups near a den during a survey. Generally, spot-light surveys were more effective in the range area than the cropland area (32% versus 16% detection rate), which may be a consequence of lower vegetation height in the range area allowing greater probability of seeing foxes.

Scent-station surveys -- We evaluated use of scent-station surveys to index relative abundance (Linhart and Knowlton 1975) of swift foxes on each study site. Six surveys were conducted approximately every four weeks from April through September. Stations consisted of a 0.37-m^2 tracking surface with bait staked in the center. Stations were placed in lines, each containing 16 stations placed 0.5 km apart. Scent-stations were placed within 15 m of the section line. A survey ran three nights, and each morning scent-stations were examined for visits. A survey night was acceptable only when weather conditions did not affect our ability to detect visits to the scent-stations. During most survey nights, movements of one (or >1 depending on available personnel) fox, whose home range was crossed by a survey line, was monitored. This provided information to evaluate sensitivity of our survey and help us define recommendations for implementation of surveys.

Across all survey periods, rates of detection on routes ranged from 10% (August) to 70% (April). When combining two survey periods, April and June or April and September, detection rate was improved to 100%.

Systematic track surveys: quarter-sections -- Systematic track surveys of 20 quarter- sections were conducted four times, approximately once every six weeks from April through mid-July. One quarter-section was randomly selected from each 10-km^2 block; the remaining 16 quarter-sections were randomly selected from the entire study area. Survey methods were similar to those described by Sargeant et al. (1993). Observers spent approximately 20 minutes surveying a quarter section for tracks, searching the available places with natural substrate on which a fox could leave a detectable track. This is a modification of scent-station surveys designed to index coyote abundance (Linhart and Knowlton 1975). This modification is reasonable if there are available tracking media (e.g.,exposed soft soil) at several sites within the quarter-section.

Tracking conditions were ascertained including number of available sites with track substrate, quality of the tracking substrate, and number of days tracks had been accumulating. The advantages of this method are that: (1) detection of presence does not rely on foxes' response to bait, (2) identification of tracks should be more reliable because a trail can be followed to examine several tracks, and (3) compared to scent-station and trapping surveys, it requires less time to conduct the survey.

In five survey periods, we detected swift fox tracks in 20% to 50% of quarter-sections in cropland area and 15% to 50% in range area. Detection was higher during the early April and late August surveys in both study areas. Combining the data from the April and August surveys resulted in a 60% detection rate in cropland area and 65% detection rate in range area. We believe the detection of swift fox tracks on quarter-sections could be improved if whole sections were randomly selected rather than quarter-sections, and then allow field personnel to select a quarter of each section with highest availability of substrate in which tracks could be found.

Systematic track surveys of roads/section lines -- Systematic surveys for tracks were conducted along the five routes on each study area. Surveys were conducted five times, approximately every six weeks, from March through August. Using an all-terrain-vehicle for transport, road and rights-of-way were examined for tracks. Location of tracks were recorded on maps of the study area. Data will be evaluated using two sampling methods: number of locations that tracks were detected on the survey route and percentage of 400-m section of the route with tracks.

Across all survey periods, detection of swift fox by route ranged from 40% (August) to 90% (June). Detection rate can be improved to 100% in several combinations of paired survey periods (March and May, May and June, June and July). The conditions (soil, accumulation period, available substrate) appear to significantly influence our ability to detect presence of swift foxes. Early examination of data seems to indicate that if swift foxes are present, under favorable conditions, the foxes will be detected by the survey.

Scat deposition transects -- Scat-deposition counts were conducted twice on each study area. An investigator walked the transect lines collecting all scats found. Approximately two week later, the transects were again searched to collect scats deposited since the first search. Rate of deposition (scats/day/km) was evaluated as a relative abundance index.

The first survey (March-April) resulted in 70% detection and the second survey (June-July) resulted in 30% detection of swift foxes. Because we were intensively radio-tracking the swift foxes, resulting in high vehicle use of roads and trails, our ability to find scats may have been reduced resulting in lower rates and, consequently under-representing swift fox activity.

FUNDING SOURCES

The research was funded by Northern Prairie Science Center, National Biological Service; Kansas Department of Wildlife and Parks; U.S. Fish and Wildlife Service; and North Dakota Game and Fish Department.

1997 RESEARCH ACTIVITIES

- A proposal for funding was submitted to the USGS Biological Resources Division Species-at-Risk Initiative to continue the evaluation of survey techniques in 1997. The proposal is currently under review.
- A proposal title "Determination of genetic variation among swift fox populations throughout their range" was submitted to the National Biological Service's Species-at-Risk Funding Initiative. Funding was denied.
- An experimental study of the relationship between swift fox and red fox will be conducted in 1997. The study is funded by the USGS Biological Resource Division.

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SURVEY OF SWIFT FOX (*VULPES VELOX*) ON PINE RIDGE OGLALA SIOUX INDIAN RESERVATION, SHANNON COUNTY, SOUTH DAKOTA

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ABSTRACT

We surveyed for swift foxes (*Vulpes velox*) on Pine Ridge Oglala Sioux Indian Reservation, Shannon County, South Dakota, between 14 July and 22 September 1996. We searched areas believed to support swift fox populations using carbon-plate stations and spotlight surveys. A total of 507 carbon-plate stations covering 102.6 km^2 were placed in potential swift fox habitat. No carbon-plate stations were visited by swift foxes. Twenty-six carbon plates were visited by other predators; 16 plates were visited by canids. Spotlight surveys covering 288.4 km were conducted nine nights for a total of 20.5 hours. One swift fox was sighted on 1 August at 2240 hrs. Domestic dogs (*Canis familiaris*), coyotes (*Canis latrans*), and red foxes (*Vulpes vulpes*) were the most abundant canids on the Reservation and their presence may be related to low observations of swift fox noted during our study.

INTRODUCTION

The distribution of the swift fox (*Vulpes velox*) originally ranged from the prairies of Alberta-Saskatchewan, Canada to the Texas-New Mexico region of North America (Scott-Brown et al. 1987). Present distribution (within the United States) of the species ranges from Montana to Texas and New Mexico (Scott-Brown et al. 1987, Giddings and Knowles 1995). Although the species is considered abundant in some portions of its range (e.g., Colorado, Kansas, and Wyoming), in South Dakota, it is listed and protected as a state threatened species. In 1995, surveys for swift fox were conducted in Fall River and western Shannon counties, South Dakota (Kruse et al. 1995). The purpose of this study was to document swift fox presence on areas previously occupied by the species within Pine Ridge Oglala Sioux Indian Reservation, Shannon County, South Dakota.

STUDY AREA

Survey work was conducted on Pine Ridge Oglala Sioux Indian Reservation, Shannon County, southwestern South Dakota. Shannon County encompasses the Pine Ridge Oglala Sioux Indian Reservation and is 543,917 ha (1,344,000 acres) in size. Vegetation within the county is typified by short-grass prairie (Westin and Malo 1978). Common grasses of the area include: little bluestem (*Andropogon scoparius*), prairie sandreed (*Calamovilfa longifolia*), needle-and-thread (*Stipa comata*), western wheatgrass (*Agropyron smithii*), blue grama (*Bouteloua gracilis*), and buffalograss (*Buchloe dactyloides*) (Westin and Malo 1978, Deisch et al. 1990). A description of the study area can be found in Kruse et al. (1995).

METHODS

Swift fox were surveyed on Pine Ridge Oglala Sioux Indian Reservation, Shannon County, South Dakota from 14 July to 22 September 1996. We surveyed portions of areas believed to support swift fox populations using carbon-plate stations and spotlight surveys. Carbon-plate stations consisted of 0.61 X 0.61 m (2=X 2=) 16-gauge sheet metal plates coated with a solution of activated carbon (Aldrich Chemical Company, Milwaukee, WI) and ethanol n-190 alcohol (Worum Chemical Company, St. Paul, MN) (37.8-56.8 g [8-12 tsp.] carbon per liter alcohol), and baited with jack mackerel (Conners Brunswick, Inc., Portland, ME). Procedures for using carbon-plate stations were outlined by Kruse et al. (1995).

Carbon-plate stations were spaced 0.4 km (0.25 miles) apart on transects located along roads (primarily gravel and grass roads). Stations were placed twenty-five paces perpendicular to the road, or, if a fence was present, on the outward-side of the fence. Stations were marked by placing colored flags at road edges; those adjacent to fences were identified by tying colored flagging onto the fence a few meters away from plates. Numbers of stations on transects varied due to road segment lengths but no transects contained more than 25 plates. Transects were maintained for three consecutive nights (weather permitting), checked for disturbance every day, and rebaited when necessary (i.e., if bait was eaten by a predator, or had dried to the point of not emitting a discernible odor). Tracks left by predators visiting stations were documented by >lifting= the remaining carbon surrounding the track (and the image of the track) from plates with clear packaging tape and transferring them to white letter paper (21.6 cm X 27.9 cm [81/2 in X 11 in]). Tracks difficult to identify but still distinguishable (i.e., due to light rain that had removed the carbon layer or if the predator left mud tracks on the plate) were measured and photographed for later identification.

We performed spotlight surveys on all transects containing carbon-plate stations and on other roads adjacent to areas believed to support swift fox populations. Local residents were notified before surveys were conducted. A 1.5 million candlepower hand-held spotlight aimed out the left side of the vehicle was used for spotlighting. Traveling speed ranged from 8 - 40 km per hour (5 - 25 mph) but most survey routes were traveled 8 - 16 km per hour (5 - 10 mph) due to rough terrain.

Only one side of the road was surveyed at a time but both sides of the road were surveyed the same evening. On one occasion, a night-vision scope was used, in addition to the spotlight, to search for swift foxes.

RESULTS AND DISCUSSION

A total of 507 carbon-plate stations were placed in potential swift fox habitat (Fig. 1). Based on a minimum home range of swift fox of 1.9 km^2 (Scott-Brown et al. 1987), approximately 102.6 km^2 (39.4 mi^2) of Shannon County were surveyed. No carbon plates were visited by swift fox. However, twenty-six plates were visited by other predators, and of those, 16 were visited by canids; six plates by red fox (*Vulpes vulpes*), one plate by a coyote (*Canis latrans*), and nine plates by domestic dogs (*Canis familiaris*) (Fig. 2). Of the remaining 10 plates visited by other predators, three were visited by domestic cats (*Felis catus*), one by raccoon (*Procyon lotor*), three by striped skunks (*Mephitis mephitis*), and three by unknown predators.

Spotlight surveys were conducted on nine nights for a total of 20.5 hours and covering 288.4 km (178.8 mi.). One swift fox was sighted on 1 August 1996 at 2240 hrs. Ten coyotes, two red foxes, two skunks, two badgers (*Taxidea taxus*), two domestic dogs, two domestic cats, three unknown canids, and five unknown species were sighted during spotlight surveys (Fig. 2).

Kruse et al. (1995) did not observe swift foxes during 36.5 hours of spotlight surveys in southwestern South Dakota, but noted that unusually high vegetation may have reduced overall movements of swift foxes and limited visibility of these small animals. Despite the fact that vegetation was shorter in 1996 due to decreased rain and a greater abundance of grasshoppers and crickets (Order Orthoptera), we observed only one swift fox during spotlight surveys. Kruse et al. (1995) observed 18 canids (six coyotes and 12 red fox) during spotlight surveys in southwestern South Dakota (Fall River and western Shannon counties). Similarly, in 1996 we observed 18 canids within the same region.

Kruse et al. (1995) reported swift fox tracks on both natural substrate and a carbon-plate station near the White River, north of Loneman, South Dakota. However, swift fox sign in the immediate vicinity was not documented in 1996, which may have been partly due to the presence of several domestic dogs traveling throughout the area during the survey period. All nine plates visited by domestic dogs occurred along a transect in this region of Shannon County; two domestic dogs were observed during spotlighting, and three dogs were seen during daylight hours. We also documented presence of both coyotes and red foxes in Wakpamani, South Dakota. In addition, five carbon-plate stations were visited by red foxes, and one plate was visited by a coyote. Fresh coyote scat was found approximately 10 m from one undisturbed carbon plate, a coyote den was located in the vicinity, and three coyotes were observed during a spotlight survey.

During a previous survey of swift fox conducted in Shannon County, McDaniel (1975) reported no less than five active den sites and nine visual observations of swift fox north of Loneman, South Dakota from 5 August to 30 October 1975. However, observations of coyotes and red fox were not noted in this report. Coyotes and red fox that occur sympatrically with San Joaquin kit fox (*Vulpes macrotis mutica*) were observed to kill kit foxes (Ralls and White 1995). During our study, we noted coyote presence (via fecal material, den sites, or vocalizations at dusk) in all but one of the areas surveyed. In addition, red foxes and domestic dogs were observed throughout the study area. Therefore, if coyotes, red foxes, and domestic dogs are direct competitors of swift foxes, the presence of these canids might be an indication that swift foxes in this area are at risk or declining.

Surveys conducted during 1996 are part of an overall strategy to document areas where swift foxes are present in South Dakota. Land management personnel associated with the Pine Ridge Oglala Sioux Tribe have incidentally observed swift foxes for a number of years. This 1996 survey effort concentrated on verifying the swift fox distribution in Shannon County, South Dakota. Results suggest that the presence of other canid species may be influencing swift fox distribution in Shannon County.

Results from 1996 sampling suggest several potential research areas. Result variations within species for the two sampling methods support one of the current research projects of Dr. Marsha Sovada, Northern Prairie Science Center, and her evaluation of survey techniques. A second research question deals with canid interaction impacts to swift fox in South Dakota. Further survey efforts will be more meaningful if census methods adequately sample swift fox as well as other canid species.

Monitoring or research efforts during 1997 are dependent on funding secured through Section 6 Endangered Species Act funding.

ACKNOWLEDGMENTS

We thank R. Bettleyoun, Bureau of Indian Affairs and R. Sherman, Pine Ridge Sioux Wildlife Department for help with access to private lands and their suggestions for survey placement. J. S. Gleason and C. D. Kost reviewed an earlier draft of this manuscript. We thank R. R. Johnson, M. E. Estey, C. J. Kopplin, and B. L. Kopplin for their technical assistance. Our study was funded by the South Dakota Department of Game, Fish and Parks (Study No. 7611) from Section 6 Endangered Species Act funds through the U. S. Fish and Wildlife Service.

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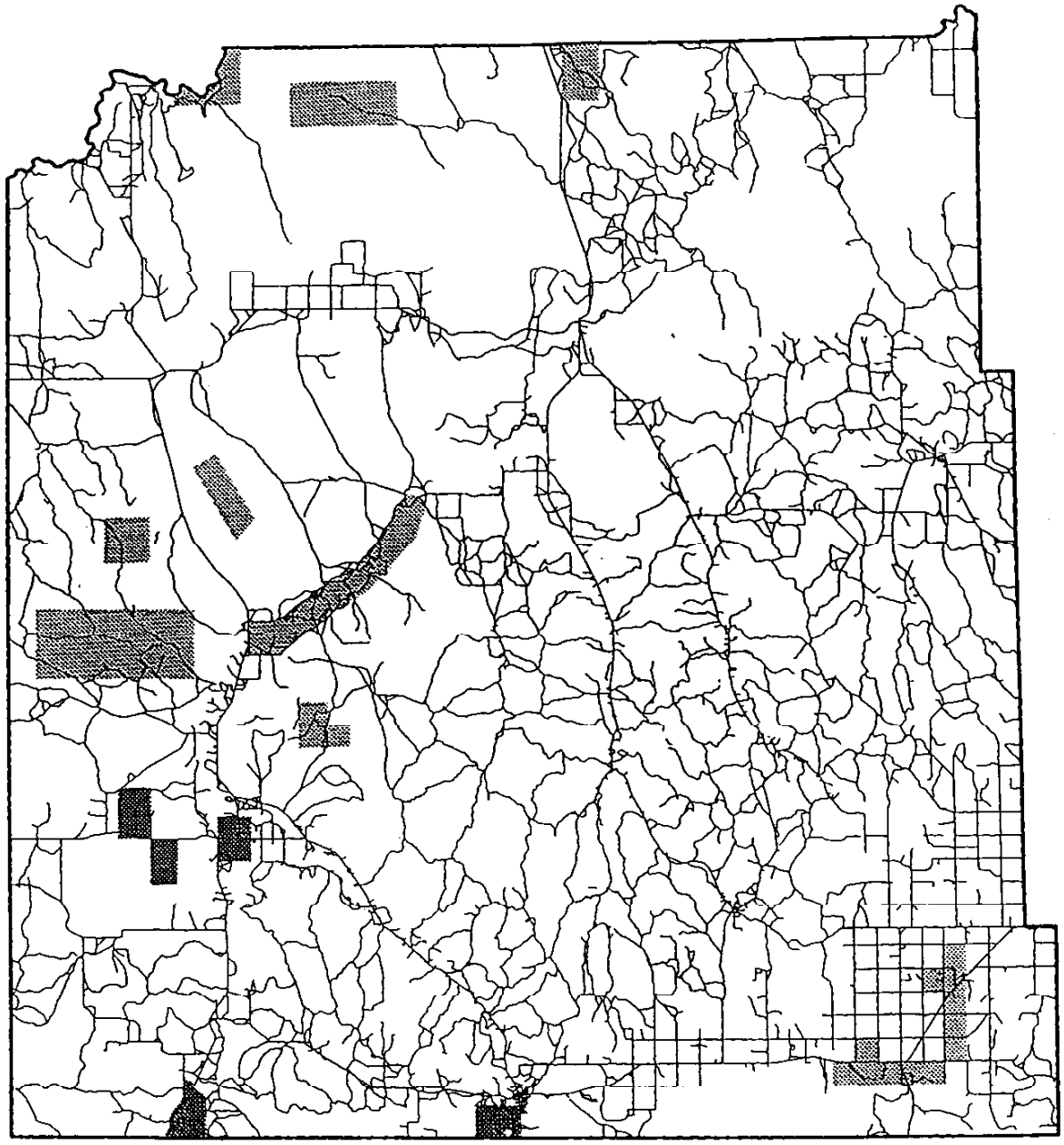


Figure 1. Locations of areas (hatched areas) reported to support swift fox populations on the Pine Ridge Sioux Indian Reservation, Shannon County, South Dakota. Only the dark hatched areas (southwestern Shannon County) were not surveyed in 1996.

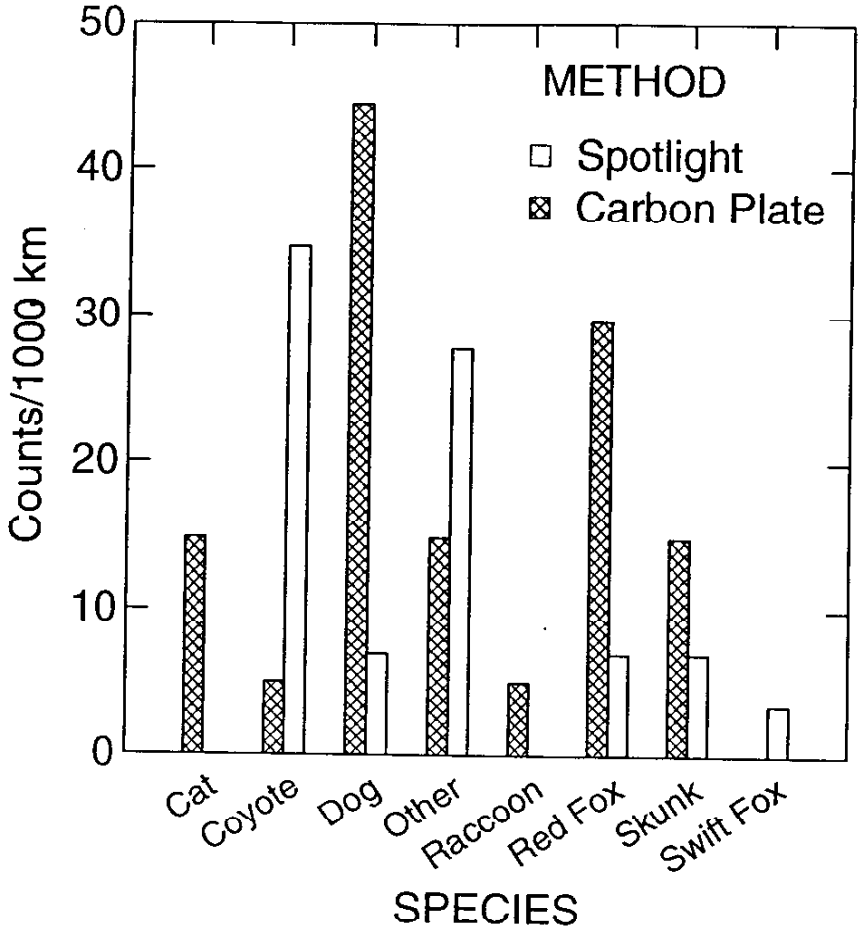


Figure 2. Counts (per 1000 km) of species observed using spotlight and carbon plate surveys on Pine Ridge Oglala Sioux Indian Reservation, Shannon County, South Dakota, July-September 1996.

1996 SWIFT FOX SURVEY

FALL RIVER RANGER DISTRICT
BUFFALO GAP NATIONAL GRASSLAND
NEBRASKA NATIONAL FOREST

by
LYNN ALLAN HETLET

INTRODUCTION

Surveys to determine locations of swift fox (*Vulpes velox*) were conducted on Buffalo Gap National Grassland from 1989 through 1995. Additional new areas were surveyed in 1996 as were the three annual routes established in 1994.

SURVEY AREAS

Approximately 2,200 acres of formerly unsurveyed areas of Buffalo Gap National Grassland in Fall River County of South Dakota were surveyed (Maps #1, #2). The established annual routes survey approximately 6,250 acres.

METHODS

Approximately 35 man-hours (including travel time) were spent establishing and utilizing bait stations on approximately 2,200 acres of grassland, and 90 man-hours (including travel time) were spent on the established annual routes.

Methods used were similar to those used last year, including the addition of vegetable oil to the sand.

RESULTS AND DISCUSSION

Although the oil/sand mixture was still an improvement over straight sand, the results this year were not as good as last year. The sand used this year was from a different location (perhaps a bit finer). Also, grasshoppers were extremely abundant, to the degree of disturbing the sand even before it was baited, just by virtue of their being in constant motion, nearly everywhere. I suspect this disturbed the sand to the point of somewhat obliterating the tracks, although I think some experimentation should be done with various sands to determine if the clarity of the track impressions varies with the fineness of the sand.

Newly Surveyed Area (Smithwick)

The new area surveyed in the Smithwick vicinity (Map #1) adjacent to the route run annually in that area, showed only striped skunk tracks (at two of sixteen stations the first night, at one the second night, and at six the third night).

Newly Surveyed Area (Oelrichs)

The new area surveyed in the Oelrichs vicinity (Map #2) yielded only striped skunk (and unidentifiable mice) tracks. The skunk tracks occurred at one of thirteen stations the first night, at none the second night, and at two the third night.

Smithwick Area

No swift fox tracks were found in the Smithwick area. In fact, only tracks of striped skunks were found here.

South Pioneer

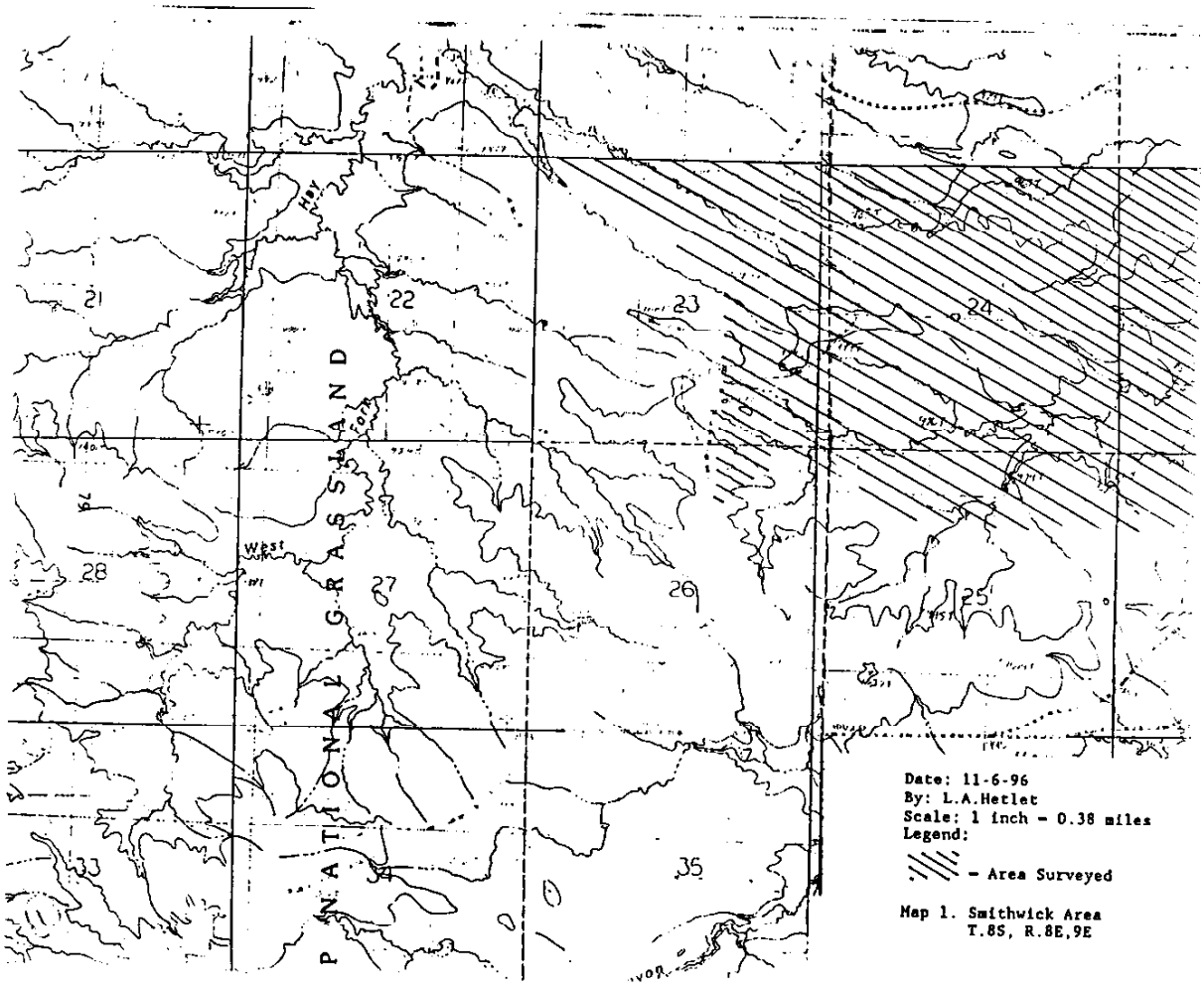
The established annual route in the Oelrichs area yielded striped skunk tracks at one station, coyote tracks at several of the stations, and no swift fox tracks.

Ardmore Area

The established annual route in the Ardmore area showed striped skunk tracks at only five stations, and coyote tracks at only two stations, over the three night run. Fifteen of the 31 stations had swift fox tracks the first night, 15 the second night, and 15 again on the third night.

One active den was found in this area (Map #3), with two swift fox seen there on two of the days that the route was run.

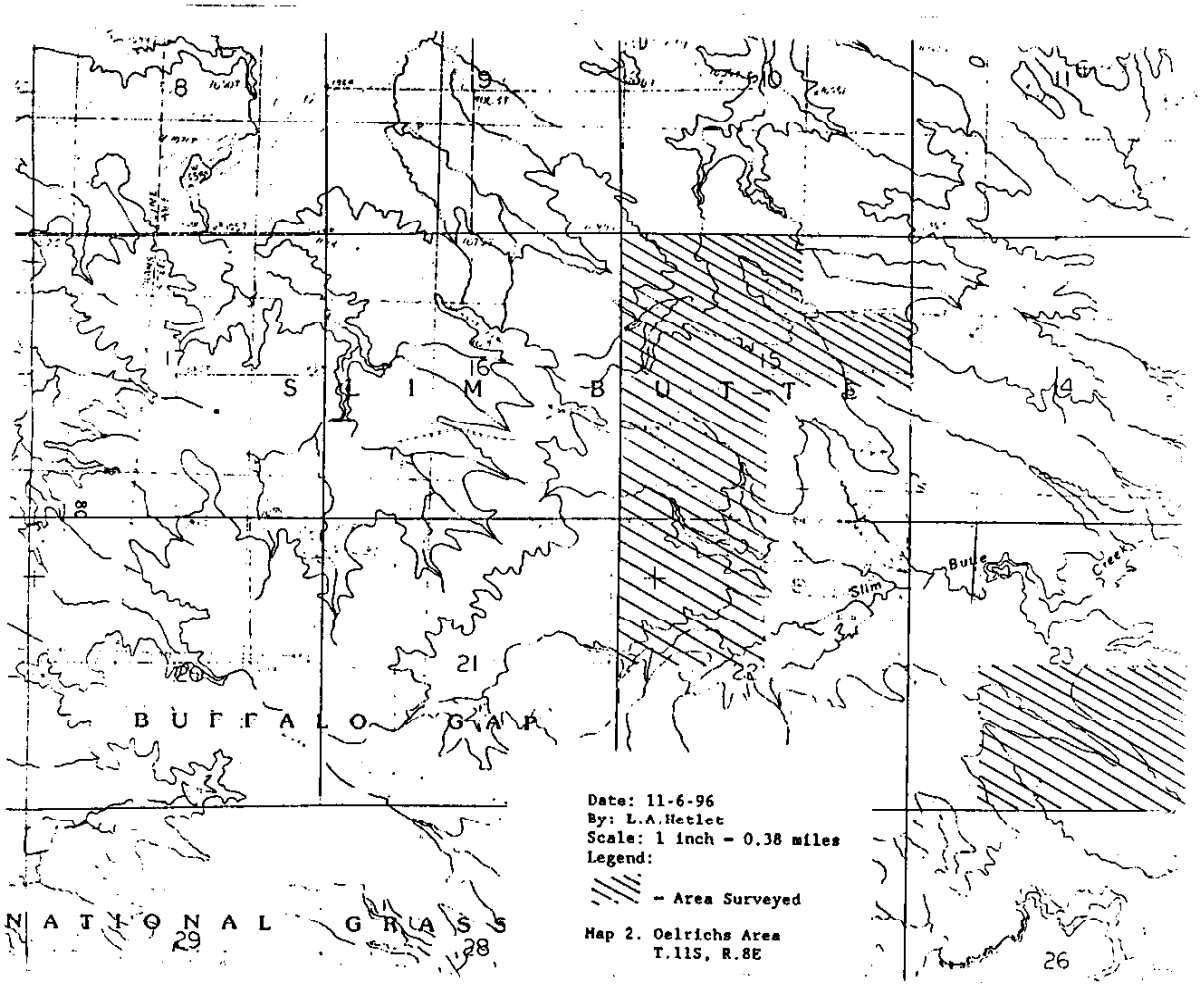
Due to the pattern of bait stations showing tracks the first morning, I suspect there are probably at least two active dens in the area.



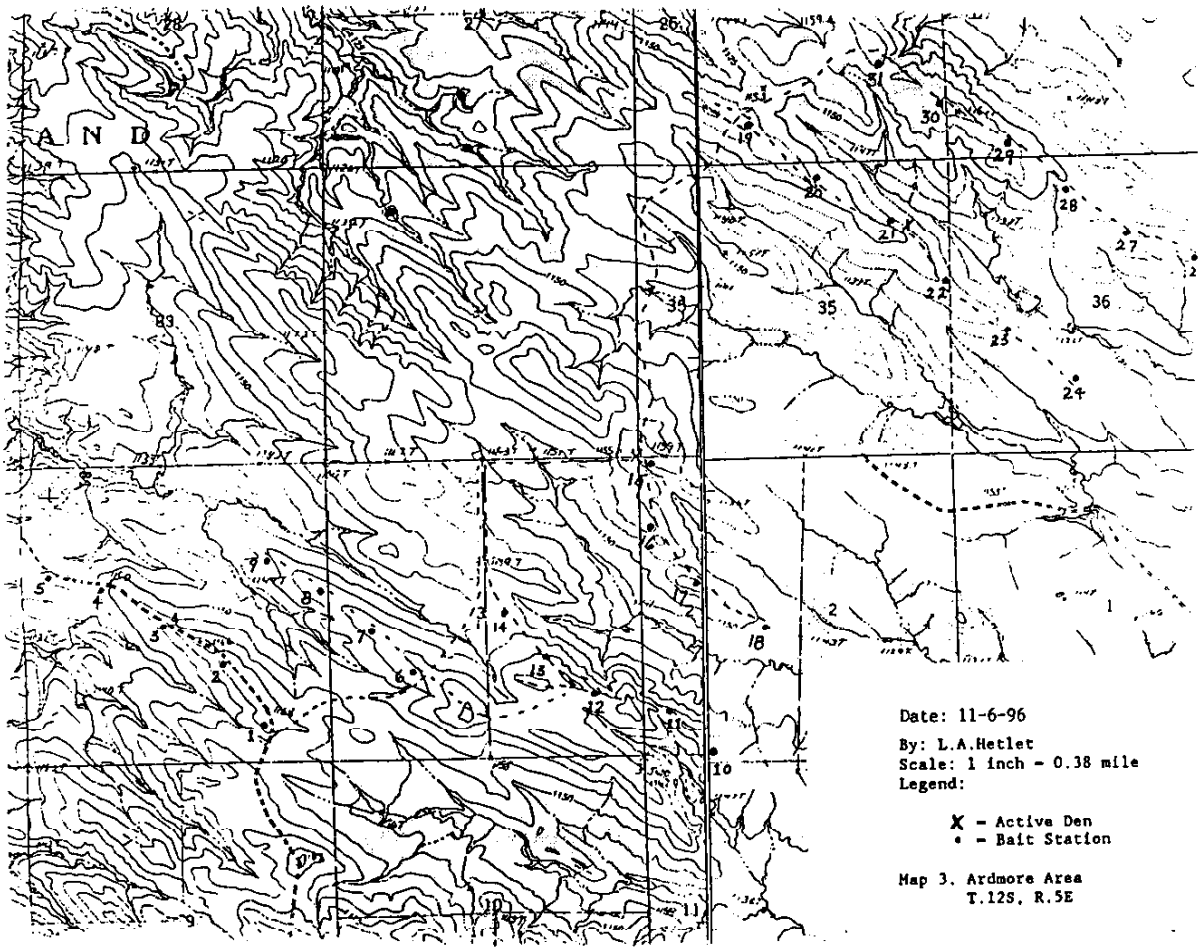
Date: 11-6-96
By: L.A.Hetlet
Scale: 1 inch = 0.38 miles
Legend:

/// = Area Surveyed

Map 1. Smithwick Area
T.8S, R.8E,9E



Map 2. Oelrichs Area
T.11S, R.8E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By: L.A.Hetlet
Scale: 1 inch = 0.38 mile
Legend:
X = Active Den
• = Bait Station
Map 3. Ardmore Area
T.12S, R.5E

Bait Station	Day 1	Day 2	Day 3
1			
2			
3			
4			
5			
6			
7			
8			
9			
10	VUVE	VUVE	VUVE
11		VUVE	
12	VUVE	VUVE	VUVE
13	VUVE		
14		VUVE	VUVE
15		VUVE	VUVE
16	CITR	VUVE	VUVE
17	VUVE	VUVE	VUVE
18	VUVE		VUVE MEME
19	VUVE	VUVE	VUVE
20	VUVE	VUVE	VUVE
21	VUVE	VUVE	VUVE
22	MEME	VUVE	VUVE
23		VUVE	VUVE
24	VUVE		VUVE
25	CALA VUVE		CALA

Bait Station	Day 1	Day 2	Day 3
26	MEME VUVE		
27	VUVE	VUVE MEME	
28	VUVE		
29	VUVE		MEME
30		VUVE	VUVE
31	VUVE	VUVE	VUVE

TABLE 1. Tracks on Ardmore Area swift fox survey route
August 6, 7, 8, 1996
VUVE - swift fox
MEME - striped skunk
CALA - coyote
CITR - thirteen-lined ground squirrel

Bait station	Day 1	Day 2	Day 3
1	MEME		
2		MEME	
3			
4			
5	MEME	MEME	
6			
7			
8			
9			MEME
10		MEME	MEME
11		MEME	MEME
12	MEME		MEME
13			
14			
15			
16	MEME		
17			

TABLE 2. Tracks on Smithwick Area swift fox survey route
July 31, Aug 1,2 1996
MEME - striped skunk

Bait station	Day 1	Day 2	Day 3
1			
2			CALA
3			CALA
4			CALA
5			
6	CALA		CALA
7	CALA		CALA
8			
9			
10			
11			
12			
13			
14			
15			CALA
16			
17			
18			
19			
20			
21			

TABLE 3. Tracks on South Pioneer Area swift fox survey route
Aug 6,7,8, 1996
CALA - coyote

1996-SWIFT FOX SURVEY
THUNDER BASIN NATIONAL GRASSLAND
DOUGLAS RANGER DISTRICT

INTRODUCTION

Historically, the Swift fox (Vulpes velox) was found throughout mixed and short-grass prairie regions of the Great Plains, from Canada to Mexico. Current distribution is in nine (9) states (from Montana to Texas) and three (3) Canadian provinces (Saskatchewan, Alberta and Manitoba). This species is listed BY EACH STATE WILDLIFE AGENCY as follows:

Montana: Furbearer -closed season
North Dakota: Furbearer -closed season
South Dakota: Threatened
Wyoming: Nongame, Species of Special Concern (SSC3)
Nebraska: Endangered
Colorado and Oklahoma: Furbearer -closed season
Kansas, New Mexico and Texas: Furbearer -open season

NOTE: Above information obtained by personal communication with Robert Hodorff, Fall River District, Nebraska National Forest (01/09/97).

In the three (3) Canadian provinces, Swift fox status is identified as:

Saskatchewan and Alberta: occurring within the historic species range.
Manitoba: Endangered

NOTE: This information was obtained from a document organized by John Sidle, Matrix of "Listed" species in the Great Plains.

In Wyoming, the Swift fox has been found in Laramie, Albany, Converse, Fremont, Goshen, Natrona, Sweetwater, and Weston counties (1995 data). Locally, the Forest Service considers the Swift fox a Region 2 Sensitive species. The Fish and Wildlife Service (USFWS), under the Endangered Species Act (ESA-1973) considers that listing this species is warrented but precluded by other higher priority actions for listing; designated as a CANDIDATE species.

Objective of our surveys was to determine IF and WHERE Swift fox exist on Thunder Basin National Grassland (TBNG). In 1995, we completed one (1) survey route. This year, two (2) survey routes were conducted to fufill Forest Plan Monitoring targets and in support of the Region 2-Sensitive species program and the Endangered Species Act. An approximate total of 3,200 acres were considered inventoried thru these surveys.

METHODS

Techniques and methods used to conduct these surveys were developed by Wyoming Cooperative Fish and Wildlife Research Unit-Tim Woolley and Frederick Lindzey. Two (2), survey transects were run along state highway, county and forest system roads on Thunder Basin National Grassland (TBNG) for three (3) consecutive nights. One (1) survey transect was conducted mainly along State highway 450 and was a thirty (30) mile transect. The other, in the Rosecrans area was a nineteen (19) mile transect because we were only equipped with 19 plates. SEE ATTATCHED MAPS Figures 1 and 2.

This is a brief description of the protocol we used. For further details on techniques, please see attatched 1995 swift fox report (**Figure 3**) and Wyoming Game and Fish protocol (**Figure 4**).

Tracking plates (30 per transect), sheet metal of 24 x 24 inches, were set out at one (1) mile intervals along each transect route. Plates were placed off the road in the public property easement. A mixture of rubbing alcohol/carbon-black powder was used to blacken the plates thus creating a tracking surface. A small piece of canned mackerel was placed on the middle of each plate as bait. The idea being an animal would be attracted to the bait, step on the plate to get it and leave tracks on the blackened plate. Plates were set out with fresh bait in the late afternoon thru evening (1600-2000 hrs), then checked for tracks during early morning hours (0600-0930 hrs). If suspected canid track prints were on the plates, these were "lifted off" using clear tape and documented with notes and when possible, photos. Each plate was collected, cleaned, blackened, baited and set out again in the late afternoon (for 2 successive days).

Two (2) transect routes were run July 9 thru 11, 1996. Personnel conducting routes included two (2) district technicians, one (1) SCA volunteer, one (1) USFWS volunteer, and one (1) college student volunteer. Locations of survey plates were recorded with notes and latitude/longitude readings.

RESULTS

Both transects were successfully completed. **One (1) SUSPECTED Swift fox track was identified during the survey.** This track was carefully documented with notes, a "lifted track" off the plate and photographs of tracks on plate. This track was CONFIRMED as a Swift fox track by WYGF Biologist (for Swift fox project) Mark Zornes on December 06, 1996. Some other tracks found on the survey plates included tracks of: rodents, skunks, possible Red fox, unidentified small mammal, possible coyote and a deer or antelope fawn track. These survey transects inventoried approximately **3,200 acres** (encompassing public, state and private lands). Since the Swift fox is a Region 2 Sensitive species and a Candidate (under the ESA) species, annual monitoring and surveys will continue on TBNG as funding permits.

OTHER/COMMENTS

Other identifications of Swift foxes were documented by district personnel during this year. They are as follows:

Swift fox carcass and possible den site: Found by Tim Byer (District Wildlife Biologist) and Mike Winters (District Minerals) on September 17, 1986. NW1/4NW1/4SW1/4 of Section 8, T39N R70W. See attatched map (**Figure 5**) for detailed location. Skeleton with skull was found near apparent den site. Skull was collected by Tim and Mike, photographs taken of skeleton and den. Biologist (for WYGF Swift fox project) Mark Zornes examined the skull and confirmed it as an adult Swift fox on December 06, 1996.

Swift fox (individual) sighting: by Lita Snell (Integrated Resource Inventory crew member) on August 26, 1996. No details about habitat, but actions observed were that the animal was running. SW1/4SE1/4 of Section 21, T45N R63W. See attatched map (**Figure 6**) for detailed location.

SIGHTINGS CONTINUED:

Swift fox (individual) sighting: by Glen Meadows and Louis Metz (Engineering personnel) on July 18, 1996 about 09:30 hrs. Animal was observed running in the ditch along the road and then ran across the road. Approximate location NE1/4NE1/4NE1/4 of Section 22, T43N R71W. Junction of the Highlight road and two-track into Little Thunder Reservior. Please see map (Figure 7) for detailed location.

Swift fox (individual) sighting: by Ryan Domsalla (Wildlife personnel) on May 31, 1996. Animal was observed running in washout drainage then crossing two-track road (observed for approximately 1 minute) in front of observer. Approximate location NW1/4SW1/4NW1/4 of Section 26, T43N R69W. Please see Figure 8 for detailed location.

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1995-SWIFT FOX SURVEY
THUNDER BASIN NATIONAL GRASSLAND
DOUGLAS RANGER DISTRICT

INTRODUCTION

Historically, the Swift fox (Vulpes velox) was found throughout mixed and short-grass prairie regions of the Great Plains, from Canada to Mexico. Current suspected range is from areas in Montana to Texas. United States Fish and Wildlife Service (USFWS) recieved a petition to list the Swift fox as endangered in at least the northern portion (Montana, North and South Dakota, and Nebraska) if not it's entire historic range. Many of these states do not consider the listing justified due to limited and anecdotal data available. In Wyoming, the Swift fox currently is considered a Region 2 Sensitive species. Under the Endangered Species Act it is considered a Candidate-Category 1 species.

Objective of this survey was to determine IF and WHERE Swift fox exist on Thunder Basin National Grassland (TBNG). This project was in conjunction with a statewide distribution survey by the Wyoming Cooperative Fish and Wildlife Research Unit-University of Wyoming and the Wyoming Game and Fish Department. It was also conducted to fufill Forest Plan Monitoring targets and in support of the Region 2-Sensitive species program and the Endangered Species Act. An approximate total of 1,920 acres were inventoried during this survey.

METHODS

Methods and techniques used to conduct this survey are the Swift fox survey protocol from the Wyoming Cooperative Fish and Wildlife Research Unit-Tim Woolley and Frederick Lindzey. A thirty (30) mile transect was run along roads in the Spring Creek Grazing Association area (north of Gillette see map) for three (3) consecutive nights. Tracking plates (30), made of sheet metal of 24 x 24 inches, were set out at one (1) mile intervals along the transect route. Plates were placed off the road in the public property easement. A mixture of rubbing alcohol/carbon-black powder was used to blacken the plates to create a tracking surface. We found that 6-8 heaping teaspoons per 1 bottle (32 ounce) of rubbing alcohol was a sufficient consistency/thickness. One (1) piece of canned mackerel (1-2 inch chunk) was placed on the middle of each plate as bait. An animal would be attracted to the bait, step on the plate to get it and leave tracks on the blackened plate. Plates were set out with fresh bait in the late afternoon thru evening (1630-2000 hrs), then checked for tracks during early morning hours (0630-0930 hrs). Each plate was collected, cleaned, blackened, baited and set out again in the late afternoon (for 2 successive days). We experimented with two (2) ways to blacken plates. One (1) way consisted of blackening all the plates at one location, then transporting them to the start of the transect. The other way was to blacken each plate at it's placement location along the transect. We found that the first way was a problem; due to plates banging against one another during transport and rubbing the black off, thus poor coverage and twice the work to re-blacken them at each location.

Figure 3

An attempt to complete one (1) transect thru the Rosecrans area of TBNG was made on July 18 and 19, 1995. The survey was abandoned due to rain the first night and following day. Another transect was located in the Spring Creek area of TBNG, north of Gillette (please see map). This survey was conducted from September 27 thru 29, 1995 by two (2) technicians and a supervisor for one (1) day, and by two (2) technicians for two (2) days. Locations of survey plates were recorded with notes, photographs and with a Global Positioning System (GPS) unit.

RESULTS

Only one (1) transect was successfully completed. Another prior attempt at another location on TBNG was not completed due to precipitation. **No Swift fox sightings or tracks occurred/ were identified during the survey.** The only tracks identified were that of mice, a squirrel and a feral cat. The last morning of the survey, a light mist/rain began early, then turned to moderate rain while picking up the last five (5) plates. Only one (1) plate was smudged by rain so badly that we could not see if tracks had been left. This survey **inventoried 1,920 acres** (encompassing public, state and private lands). Since this is a Regional Sensitive and Candidate (under the Endangered Species Act) species, annual monitoring and surveys will continue on TBNG as funding permits.

SWIFT FOX TRACKING PLATE SURVEY PROTOCOL

1. The tracking plates should be somewhat clean and smooth. If not, use a "scotch brite" pad or some coarse steel wool to clean up areas where rust or old bait have adhered to the surface.

2. At the beginning of the transect, reset trip odometer at an identifiable landmark, e.g., beginning of road, sign, etc. At the first mile, stop and place the tracking plate near the right-of-way fence (if present) or within the easement. Easements may vary in distance from the road so if you are unsure, contact the county about the distance for the particular road you are going to use, or obtain landowner permission.

3. There are two ways to prepare tracking surface:

   a) To prepare the alcohol/carbon tracking medium, put about 7-15 heaping teaspoons carbon into the 1 liter plastic bottle and fill about 3/4 full with alcohol and mix. Squirt the alcohol/carbon mixture on the plate and then lift and move the plate around so that the mixture covers the plate. Adjustments to the proportions of carbon/alcohol may be needed if the surface has too little or too much carbon.

   b) An acetylene torch also can be used to blacken the plates, but all safety instructions that accompany the torch outfit should be followed, including wearing safety glasses and a respirator. Use only the acetylene to create a black, sooty smoke. Use the end of the flame to apply the black coating across the plate. Do not keep the flame in one spot too long because heating the metal will cause it to become permanently black, making footprints difficult to read.

After the surfaces are prepared place a "pinch" of mackerel in the center (we are trying to attract them, not feed them) and place some surveyors' ribbon on the fence to help find the plate the following day.

4. Transects can be placed out morning or evening and then checked once daily for two or three days. Plates should be left out longer if the weather has affected the tracking surface. During the summer months plates should be placed out in the evening hours and then checked the next morning because thundershowers will wash off the carbon coating.

5. Record all swift fox tracks (and those that might be) on the data sheet using clear packing tape. The tape can be folded over and rolled across the track and then taped onto a sheet of paper with the *date, location, Wildlife Observation System habitat code, and observer's name.* It is extremely important that the tracks are lifted and then stored carefully.

6. Likely swift fox habitat has been described as short-, mid-, and mixedgrass prairie types with flat to gently rolling topography. Swift fox have also been found to have dens in cultivated fields, near buildings, graveyards, and in sagebrush habitat types.

Figure 4

Swift Fox Survey
1996

Pine Ridge Ranger District
Oglala National Grassland
Nebraska National Forest

Introduction

Approximately 4,164 acres were surveyed between August 20 and August 23 for evidence of swift fox (Vulpes velox) on the Oglala National Grassland. Total survey hours were 26. Day surveys accounted for all of the above hours and an additional 9 hours was used for travel to and from the survey area. Eight hundred and seventy one acres were surveyed on pasture 25C, 1903 acres on 28N, and 1391 acres on 26.

The 1996 surveys were conducted on previously known swift fox surveys. The survey area was in pastures 25C, 26, and 28N (T35N R52W, R53W). Visual sightings were also conducted around the area and in pasture 27N, private lands around the survey area, and parts of 25B and 24N. The total visual survey was 640 acres.

Area characteristics

The topography is characterized by gently rolling hills interspersed with moderate to steep drainages, and the occasional steep sided erosional remnant.

The basic soil type of this area is a clay to sandy clay with areas of shale, poorly cemented sandstone and rocky outwash not uncommon.

Vegetation within the survey area consists mainly of western wheatgrass (Agropyron smithii), buffalo grass (Buchloe dactyloides), needleandthread (Stipa spartea), blue gramma (Bouteloua gracilis), and downy brome (Bromus tectorum).

Methods

Surveys conducted during the day were performed on a pasture to pasture basis insuring complete and thorough coverage. Day surveys consisted of looking for denning sites and the inspection of these sites for scat, food remains, and tracks. The shore line of all stock dams and other water stations were checked for swift fox tracks.

Vehicles used during the day survey was a mid-sized 2-wheel vehicle and a 4-wheeler (HONDA 4Trax).

Findings

Day surveys revealed no evidence of swift fox inhabiting the Oglala National Grasslands. Several dens did look to be

possible swift fox dens, but all dens appeared to be abandoned (swift fox use their dens year around).

Conclusion

The swift fox survey of 1996 revealed a warrant to justify the continued search for the swift fox on the ONG. Further recommendations include doing more night surveys with scent stations as conducted in 1993.

Reply text:
From: Peter McDonald:R02F07D06A
Date: Dec 02,96 4:36 PM

EAST HALF OF THE BUFFALO GAP NATIONAL GRASSLANDS
WALL, SD AND THE BADLANDS NATIONAL PARK

Although we didn't set out to do swift fox surveys this year, our BFF surveys would probably meet spotlight protocol for fox. We covered about 2,000 acres and didn't see any swift fox. However, 2 swift fox were believed to have been seen during concurrent spotlight surveys (August) in Burns Basin on the Badlands NP, about 1.5 miles north of the grasslands.

Reply text:
From: JERRY CLINE:R02F12D07A
Date: Dec 02,96 4:56 PM

CIMARRON NATIONAL GRASSLANDS
ELKHART, KANSAS

COMANCHE NATIONAL GRASSLANDS
SPRINGFIELD, COLORADO

We didn't so any surveys for swift fox this year. We did hav several sightings and those were documented and will be submnitted to the Colorado Natural Heritage Program for inclusion in the data base the maintain. Jerry

Reply text:
From: Mark Ball:R02F10A
Date: Nov 25,96 4:34 PM

PAWNEE NATIONAL GRASSLANDS
GREELEY, COLORADO

We spotlighted for six hours on three consecutive nights at the end of August. We traveled the county roads between 15 and 20 mph, spotlighting out of both sides of the vehicle. We averaged three sightings per hour in the shortgrass habitat. We want to survey again this spring to see how the method works during the worst time of year for spotlighting the fox.

Reply text:
From: Glenn Moravek:R02F07D06A
Date: Nov 25,96 11:55 AM

FORT PIERRE NATIONAL GRASSLANDS
PIERRE, SOUTH DAKOTA

No swift fox surveys were done on FPNG in 1996...

Minutes of Swift Fox Conservation Team Meeting
December *11, 1996*
Omaha, Nebraska

Meeting conducted by Swift Fox Conservation Team Chair Brian Giddings, Montana
Attendance list of 31 participants is attached

Presentation by Dave Allardyce - USFWS:

- USFWS congratulated states on 1995 report and work on conservation strategy
- Dave A. admitted 90 day and 1 year findings were very slow in getting out; bottom line was a warranted but precluded finding was appropriate
- USFWS now released from moratorium on listing additional species or critical habitat
- listing actions currently mostly restricted to priorities 1 and 2

- currently working on 182 species; even species of high priority are currently on "back burner"
- USFWS believes that swift fox have a high immediacy of threat and a low magnitude of threat. A major concern of the USFWS is availability and conversion and habitat and resulting impacts of interspecific competition.
- based on 1995 swift fox report and distribution data, listing as endangered does not appear warranted. However, the USFWS will be considering a rangewide threatened status.
- USFWS Regional Office does not appear to be giving clear direction on course to take with swift fox listing. ESA funding for Region 6 is very low priority. Listing and prelisting funds are limited. Other factors affecting action include USFWS reorganization and the fact that swift fox is not a high priority species for listing in Region 6.
- if USFWS completes a one-year finding this year, Allardyce will recommend that swift fox status be maintained as a warranted but precluded species with continued listing priority of 8.
- according to Allardyce, USFWS needs to make decision in one year for swift fox; may make special rules for federal lands, but not interfere with state activities

- NM study-Nancy Matthews - couldn't easily distinguish kit fox and swift fox - may be real problems in current taxonomy; need more DNA work to sort out
- 80 species on warranted but precluded list for 2 years; 40 for about 8 years
- no current "intent to sue" actions pending against USFWS to force listing of swift fox

Questions:
- Texas - Are we doing sufficient data collection to prevent listing? Yes. Someone would have to sue to show current work is insufficient.
- South Dakota - Has petitioner been involved in recent swift fox conservation efforts? Petitioner is currently in poor health and has not been recently involved in the issue.
- Wyoming - Lawsuit status? There are currently 70 suits filed against ESA activities - 1 on swift fox; currently not active.

- Funding:
  ESA money in USFWS Region 6 cut drastically

Section 6 funding (ESA)-most funding requests will probably be rejected
state directors should lobby for reinstatement of Section 6 funding
- Colorado - Will decision be made on threatened status in FY96? USFWS would like to know:
what is the current conversion rate of land use types
how adaptable are swift fox
how important are interspecific competition and population viability? Population viability may not currently be possible across range.
- response from Colorado: Doesn't sound like USFWS really knows what they are looking for. Are we dealing with a moving target? What is central to making final decision on listing? Rangewide distribution will remove viability questions.
- USFWS - population estimates appear difficult to understand in Conservation Strategy
Oklahoma - Mark Lomolino, University of Oklahoma - distribution grossly overstated for Oklahoma
- Brian Giddings, Montana - distribution maps are a start; not necessarily correct; more data will improve them. Conservation Strategy document is a good start that can be corrected as we go.
- Colorado - Will USFWS prepare report on threatened status with criteria used and distribute this information to the swift fox team?
- APHIS - How does ADC respond to swift fox populations and still respond to ADC needs? USFWS doesn't see problem this year, but possibly later.
- Swift fox annual report format discussed and no significant changes recommended.
- Coordination with state agencies: Federal Register is a poor route to inform states of pending actions. USFWS should inform states directly.
- USFWS comment - threatened vs. endangered status decision very subjective (political?)

Reports by Swift Fox Conservation Team Agencies:

Texas - Peggy Horner and Kevin Mote, Texas Parks and Wildlife

- Peggy Horner is being replaced on SFCT by Kevin Mote, whose job location and responsibilities will allow him to concentrate on prairie species.
- gave handout of survey efforts
- swift fox found recently in two counties; 8 of 20 chalk track plates had tracks in a recent survey (high success in two of the survey areas)
- experienced problems with landowner considerations; therefore, surveys were limited to county roads
- some survey figures: 1368 track plates nights at 25 locations (excludes untrackable), for total of 560 miles of survey lines
- survey routes were 20 miles long, with plates placed at 1 mile intervals; surrounding habitat is being mapped within 1/4 mile of survey line; surveys include spotlighting and track plates
- private land in Texas contains the best contiguous shortgrass prairie habitats
- future efforts will include less emphasis on surveys, but better coverage of private lands having good swift fox habitat potential
- Natural Resources Conservation Service (NRCS) range maps aren't specific enough to classify potential swift fox habitat in Texas

- plan to cover all counties with potential habitat on high plains, but plans not yet final

New Mexico - Greg Schmitt, New Mexico Department of Game and Fish

- are starting track plate surveys, using carbon plates with mackerel bait. Three counties in northeastern New Mexico have been completed to date.
- have found evidence of swift fox on all three transects completed so far; following-up with spotlighting; have found one swift fox/survey thus far.
- they plan similar surveys in 13 counties in 1997, in areas with evidence of potential swift fox; there is swift fox specimen evidence from southern New Mexico.
- they plan to collect specimens of swift fox throughout their New Mexico distribution
- they are commonly finding road kills during their survey efforts and incidentally
- APHIS-ADC takes swift fox incidentally every year in NM (11 last year, mostly in the trans-Pecos area.) This is the only state in which this is true; however, the animals may be kit fox.
- some blood collection is being done by Nancy Matthews of the University of Wisconsin. These collection efforts are concentrating on kit fox, since they're collecting in areas where swift fox aren't known to occur in the state.
- they will be contracting with Robert Harrison, of the University of New Mexico, who will concentrate on swift fox
- specimen collection will hopefully aid in resolving genetics questions between swift and kit fox
- there is state agency support for swift fox efforts, but limited resources and staff

Oklahoma - Julianne Whitaker Hoagland, Oklahoma Department of Wildlife Conservation (absent)

Presentation by Mark Lomolino, Oklahoma Biological Survey and Natural Heritage Program:

- current research is Section 6-supported to examine habitat affinities and spatial overlap between swift fox and other canids
- techniques: spotlighting, cameras, and tracking plates (plates most effective); 91 plates placed at survey sites in Oklahoma panhandle
  1 meter plates placed for three days; follow-up with motion-sensitive infrared camera
- they plan to survey during all four seasons in the three panhandle counties (Cimarron, Texas, and Beaver)
- seeing best densities in northwestern section of the panhandle (mesa habitat), with a few stragglers from Texas and Kansas
- areas with less intensive agriculture/grazing have highest swift fox numbers
- macrohabitat preferences: prairie dog towns have highest detection for carnivores, including swift fox, followed by rangeland, mesa, and riparian (no statistics completed yet);
- they also surveyed near the Oklahoma panhandle, with one hit on track plates
- they plan additional surveys to refine swift fox macrohabitat preferences and are currently working on GAP analysis

Kansas - Christiane Roy, Kansas Department of Wildlife and Parks

- Christiane has replaced Lloyd Fox as Kansas' SFCT representative
- no changes to last year's distribution information, which includes swift fox presence in 21 counties
- research on den sites completed; no differences between cropland and rangeland in number of dens; crop sites had taller vegetation and more relief around the site; swift fox are using both types of habitat for denning
- 33 swift fox harvested this year in Kansas, part of a downward trend; state is working to educate trappers on ways to avoid taking swift fox
- pelt-tagging required in Kansas, with trapping site recorded; trappers are also finding swift fox in both crop sites and shortgrass prairie; similar pelt-tagging system probably unlikely to happen in Texas or New Mexico
- they've seen an increase in number of swift fox found during roadside surveys by agency personnel; lower canines are collected for aging specimens; many roadside kills are young animals
- state will propose in 1997 to close the hunting season on swift fox, mostly based on politics rather than biological data; if this happens, the agency will lose this data source
- red fox are more common around towns in western Kansas than before
- comment on observation in Canada, where a red fox apparently evicted a swift fox family from the swift fox den site

Colorado - Tom Beck and Rick Kahn, Colorado Division of Wildlife

Tom Beck will replace Rick Kahn as Colorado's representative on SFCT

Presentation by Jim Fitzgerald, University of Northern Colorado:

- research includes two studies
  plains study site has 20 miles of trapping area, with 72 plots (foxes taken from 72% of the plots {5 fox/plot}; they are concentrating on the best potential habitat - shortgrass prairies)
  almost all of sample sites on private land; good cooperation from landowners
- very few prairie dog towns in study area; little trap success in June and July; November through early spring is most successful trapping period
- haven't spent much time sampling in cropland

- second study, Pawnee National Grassland, to determine production and mortality on radioed animals; few pups radioed; trying to improve capture of pups and trap-shy animals
- using infrared cameras to try to verify survey results
- also working on marking techniques for individual animals
- they believe they're capturing about 60% of animals from this study area
  very little pup production recently at study sites; producing about 3 pups/den, but seeing high mortality after dispersal from dens, from unknown causes
- home ranges seem smaller in Colorado compared to other sites. Could this be related to population density?

Wyoming - Bob Luce, Wyoming Game and Fish Department

- state receives no Section 6 funding for swift fox; Game and Fish Department has a funding agreement with the state Agriculture Department. These funds are being used for carnivore work. This source will fund 1997 swift fox work.
- recent survey site is near black-footed ferret Shirley Basin reintroduction site (atypical swift fox site), with a second site in more typical swift fox habitat
- agency's nongame strategic plan recently completed; SFCT objectives incorporated into their state swift fox objectives
- GAP analysis is completed in WY and will be incorporated into future swift fox work
- they are seeing an increasing swift fox population near Shirley Basin

Presentation by Tim Woolley:

- captured swift fox with box traps to compare survey effectiveness of spotlights, tracking plates and scat counts; captured 16 fox (1.6/100 trap nights) with 1-inch mesh Tru-Catch traps, with no jaw breakage
- swift fox ate some scent tabs
- used transect as the independent experimental unit, since plates weren't independent of each other; transects were randomly distributed within survey site
- spotlighted 95 miles of road three times; track plates spaced at 0.1 mile intervals
  spotlighting results showed quite a few unmarked swift fox, particularly in late summer and fall; spring density of 28 swift fox, 1.6 per 10 square km; no fall estimate available
- when survey techniques are compared: track plates showed higher densities in fall, spotlighting the same pattern, and scat counts showed higher detection frequencies in fall
- track plates showed good results from just one night

- Conclusions: need spring surveys! Use combination of indices.
- 13 of 16 marked animals are still alive.
- this technique is very sensitive to the presence of the marked animals within the area during the survey time. This technique does not work unless at least 50% of the population is marked, according to Tom Beck, Colorado.
- very low sightability; not much predator control in this area recently, so coyotes seem to be rebounding.
- study area has a few small prairie dog towns
- no red fox has ever been spotlighted in Shirley Basin; one red fox was observed near the study area, but not during a survey
- discussion on potential impact of taking swift fox from Wyoming for Canadian reintroduction: efforts should perhaps be better distributed
  USFWS has expressed a concern about decline in trapping success by Lu Carbyn in Wyoming in 1996

Nebraska - Frank Andelt, Nebraska Game and Parks Commission

- plan to collect blood samples for genetics work, but slow in getting things underway this year

Presentation by Dave Williams, APHIS-ADC:
- APHIS-ADC is working cooperatively with Nebraska Game and Parks to trap swift fox
- APHIS-ADC began trapping December 2, with 25 traps/night, in an area where cattle were recently removed;
  prey base - small rodents, lagomorphs, no prairie dogs
  there is a history of coyote control in the area
  they have captured 6 swift fox, which were bled and ear-tagged
- trapping area is 8 sections of land south of Harrison, Nebraska

South Dakota - Eileen Dowd Stukel, South Dakota Department of Game, Fish and Parks

- described background for 1996 surveys on Pine Ridge Indian Reservation (Shannon County)

Presentation by Jon Jenks, South Dakota State University:
- used maps provided by Pine Ridge reservation personnel; note that these were not necessarily recent sightings and maps included numerous sightings made over a number of years
- placed 500 carbon plate stations - no tracks found
- spotlight surveys were also conducted around plate station areas
- made a number of observations of dogs, coyotes and red fox
- had one visual swift fox observation; Len McDaniels previous survey (late 1970s) on Pine Ridge showed several den sites close to the 1996 observation site (5 den sites and 9 swift fox - observations during McDaniels work)
- Dorothy Datio, 1996 technician, saw many dog tracks in the area of the swift fox observation; were dogs affecting sampling of swift fox in this area?
- species observed: coyotes, dogs, red fox, raccoon, skunk, cat, swift fox
- sampling in June 1995 was unsuccessful, but it was a wet year.

Presentation by Bob Hodorff, U.S. Forest Service:
- no swift fox sightings on Fort Pierre National Grassland
- no swift fox seen on Buffalo Gap National Grassland (portion containing ferret reintroduction site), but two possible sightings in Badlands National Park
- other portion of Buffalo Gap National Grassland - Ardmore area still has swift fox, but not found elsewhere within the Forest Service lands in South Dakota

North Dakota - Steve Allen, North Dakota Game and Fish Department

- sampling concentrated in southwestern North Dakota
- sampled randomly-selected quarter section, using the best area to track within the quarter section
- spent a set amount of time searching for tracks, following technique of Sargeant et al.; conducted prior to the first week of June to avoid red fox pups; usually begin in mid-April
- 39 samples conducted this past year; no swift fox, but finding other carnivores; if swift fox are there, they occur at very low levels
- North Dakota has had 4 confirmed swift fox observations since 1970

- last incidental catch was in 1994; follow-up showed no further evidence of swift fox in the area

Montana - Brian Giddings, Montana Fish, Wildlife and Parks

- described background for current research study, to document resident population in state
- foxes present, although unknown distribution, population size, and status

Presentation by Amy Zimmerman, Montana State University/Montana Fish, Wildlife and Parks:
- two year study
- study area in northcentral Montana, just south of Canadian border, adjacent to release sites
- study objectives: determine current distribution and gather ecological data, particularly natal den site information and home range sizes
- set 16-20 traps/township, primarily in Blaine County; there are additional sites for future trapping efforts
  have captured 9 foxes, three females will hopefully help reveal natal den sites next spring

National Biological Service (now U.S. Geological Survey/Biological Resources Division) - Marsha Sovada, Northern Prairie Science Center

- Kansas research work - objectives are to evaluate survey techniques for detection and population indices, using a rangeland site and a cropland site
  had a 100 square mile goal, trying to trap as many animals as possible within site
- techniques: spotlighting, quarter-section scent stations, scent deposition, line transects along roads and adjacent to roads
- were fairly successful in trapping; five survey routes of 5 miles length within the study sites
- 6 square mile home ranges found with convex polygon method; female home ranges were slightly smaller, but not significantly
- some home ranges shifted with time, but these results are preliminary
- mortality - 55% for adults; coyotes were the most serious factor
  an individual fox had a 28% probability of being coyote-killed from March - September; roadkills were a secondary mortality factor
- also examined small mammal abundance, with emphasis on kangaroo rats and lagomorphs
- spotlighting showed low detection of swift fox (25%); had a limited view in agricultural lands
- quarter-section method could be improved, but had 15-25%; improved to 55-60% when surveys were combined
- recorded weather data and track conditions (would animal leave a track?)
- observed very few unmarked animals
- line transects: five mile route was observed for tracks, using ATVs; detection 40-90%; when surveys were combined increased to 60-90%; limited by scheduling constraints; this was a fairly good method in both range and cropland sites, with slightly lower detection in rangeland
- based on one year of data, CRP land wasn't used by swift fox
- scent stations: 18 stations/route; nailed scent tab down; conducted 6 surveys - 10-70% detection rates, with 30-100% when surveys combined; increased detection in September when pups were out; compared steel plate to sand plot (twice as many hits on sand plot as

steel plate); sifted sand mixed with mineral oil; this mixture is not as affected by wind as is carbon
- saw territoriality, with some overlap; den sites might be very close to each other, but foraging areas differed
- next year, Marsha would like to continue Kansas work and begin work in Wyoming; to secure additional funding, Marsha needs letters of support from USFWS and state wildlife agencies
- also will be working on swift fox-red fox interactions in captivity in 1997 (has 14 swift fox that will need disposal when research ends - some may be pregnant)
- scat deposition test in Kansas was probably not meaningful, since they were doing lots of road travel for radio telemetry
- used transect lines as their sample points, rather than scent post sites; Marsha recommends that this be considered as standard
- two graduate students will be working on Pinyon Canyon, under Eric Gese, USDA Denver Wildlife Research Center, to examine coyote-swift fox interactions

Canada - Axel Moehrenschlager, Oxford University

- described history of Canadian reintroduction: 868 released since 1983 (797 captive-bred and 71 translocated)
- 80 additional swift fox from South Dakota, Colorado, and Wyoming have supplemented captive breeding population since 1973
- Canada currently has 2 different subpopulations that are isolated from each other
- have captured 98 swift fox since January, 1995; 95% have been wild-born
- 1995 mortality - 56%; pup recruitment wasn't replacing adult losses
- 1996 mortality - 37%; high pup productivity
- current census; 78 of 106 eligible townships are being monitored with traps along transects (6 traps along 6 km. long transects); trying to learn how likely swift fox are to be trapped
- current Canadian population estimate: 400-500 swift fox
- uncertain whether minimum viable population size has been attained; in fact, not known what a minimum viable population is
- average home range - 33.8 square km
- coyotes caused 50% of mortality; other mortality factors were avian predators and poisoning
- comparison between Wyoming translocated animals and captive-bred animals: Wyoming animals had a higher short-term survival rate, particularly during 3 months following release. However, these were compared across different areas and in different years and was therefore not a direct comparison.
- 3/4 of his transects are in native prairie; no captures yet in agricultural sites
- conclusion is that reintroduction can work
- current research will conclude in October, 1997

- federal and provincial governments will be withdrawing financial backing of captive breeding in Canada, but will not discourage private commitments to captive breeding.
- effects of pipeline construction in the study area: 4 collared animals were left at the time and didn't change movements

- Axel will be looking at swift fox-coyote interactions

- Canada would like to continue reintroduction with animals from Wyoming
- Axel did research on radio collar effects on captive animals
  saw short-term behavioral changes (neck-scratching, destruction of collars by pups, which wasn't observed with the second litter). He discourages collaring when parents still have pups, because of possible early breakup of family.

Report of the SFCT Research Committee - Marsha Sovada

- Marsha requested that states provide a list of research priorities to her by the end of March to capitalize on funding opportunities; suggestion was made that these priorities be incorporated into SFCT annual report
- Marsha is willing to write a draft field sampling protocol, after receiving input from individuals currently doing swift fox surveys
- discussion on new proposal for genetics work; proposal is to help determine if swift fox populations are inbred, not to differentiate between kit fox and swift fox
  blood samples will be needed from as many sites as possible
- proposal would be submitted for Species-at-risk funding - $65,000 request for the genetics study
- discussion on whether this study has the highest current research priority for the SFCT; Rick Kahn and Lloyd Fox have a previously-submitted proposal on swift fox den site characteristic investigation; Christiane also plans to submit a proposal for an educational video about swift fox.
- after a lengthy discussion and approval by the SFCT, Marsha and Christiane will submit their proposals as planned

- there is interest in a formal swift fox symposium in late winter, 1998
  need to involve kit fox research people and Canadian swift fox researchers
  commitment to the symposium from Lu Carbyn and Northern Prairie Science Center
- suggestion that the SFCT delay its 1998 annual meeting until February or March; possible sites - Medicine Hat, Alberta or Bismarck, ND

Discussion on Final Conservation Assessment and Conservation Strategy Document:

- Discussion on how best to depict swift fox harvest, considering how trapper effort changes through time.
- How do we define suitable habitat for swift fox?

Note that these two questions were unresolved and may need further discussion at upcoming meeting(s).

- Request for updated maps from each state for the two map types (current distribution and suitable habitat). States will define suitable habitat for swift fox in their respective state - define on maps. Map should show current distribution, historical range, and suitable habitat

- Suggestion that data through 1995 be used for maps. Send to Brian Giddings by end of December, 1996.
- Maps will be put in appendix A.
- Appendix B will include summarized public comments.

- Document should also include appendices listing current SFCT members and state agency commitment letter.

Conservation Strategy Priorities for Next Two Years:

- suggestion that we examine impacts of plague and distemper, as long we people are collecting swift fox blood. Wyoming took blood from about 10 animals; Beth Williams, Wyoming State Veterinary Lab, found antibodies to plague and distemper in nearly all of these animals.
- Also appropriate to compare disease evidence in other carnivores, building on ferret disease work in Wyoming, South Dakota, and Montana.
- How should the SFCT begin to address some of the deadlines listed in Cons. Strategy document?

- discussion on which topics would benefit from technical working groups
  description of habitat criteria, based on past studies
  reintroduction techniques (strategy 7.1.3) - Colorado Division of Wildlife will take lead
  education and information needs

SFCT Assignments:

- Habitat criteria technical committee: Bob Luce, Mark Lomolino

- Research Committee: Eric Gese, Christiane Roy, Mark Lomolino, Bill Andelt, Marsha Sovada, and Fred Lindzey

- Education Technical Committee: Julianne Whitaker Hoagland, Peggy Horner, and Frank Andelt

- Technical report editors for 1996: Bob Luce and Fred Lindzey, Wyoming

- Brian Giddings will "finalize" Conservation Strategy document.

- 1997 SFCT Chair: Eileen Dowd Stukel
- 1997 SFCT Assistant Chair: Steve Allen

1997 SFCT Meeting Time and Place:

- The Wildlife Society's 1997 Annual Meeting will be 21-27 September in Snowmass, CO
  SFCT 1997 meeting is tentatively scheduled in conjunction with TWS meeting, with SFCT meeting to be held on September 22. This scheduling will allow additional meeting

opportunities for SFCT technical committees, if necessary. Rick Kahn has reserved a meeting room for 9:00 a.m. - 4:30 p.m. on Monday, September 22.

1996 meeting minutes taken by Steve Allen and Eileen Dowd Stukel

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OMAHA, NEBRASKA (DECEMBER 11, 1996)

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